November 26, 1997

EA 97-079

Mr. Ted C. Feigenbaum
Executive Vice President and Chief Nuclear Officer
c/o Mr. R. A. Mellor, Director
Site Operations and Decommissioning
Connecticut Yankee Atomic Power Company
362 Injun Hollow Road
East Hampton, CT 06424-3099

SUBJECT: NRC INTEGRATED INSPECTION REPORT 50-213/97-05

Dear Mr. Feigenbaum:

On October 6, 1997, the NRC completed an inspection at Connecticut Yankee Atomic Power Company. The enclosed report presents the results of that inspection.

During the three-month period covered by this inspection period, the Haddam Neck staff continued to assure the safe storage of spent fuel, and addressed several issues important to shutdown operations and to decommissioning. A good regard for plant spent fuel safety was noted in your efforts to address Bulletin 94-01 issues and the consequences of beyond design basis events, a total loss of pool water. Several events challenged operators, including an inadvertent actuation of the halon system that caused operators to leave the control room for about forty-five minutes. Our inspection noted other concerns in the areas of procedure quality, personnel errors, poor material conditions, and the tracking of commitments. We encourage your efforts to improve performance in these areas. Progress was noted in the completion of actions to plan for decommissioning. The radiological controls for routine work was acceptable, and the actions to address weaknesses in the program to calibrate the radiation monitoring system were well conceived and executed.

In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice," a copy of this letter and its enclosures will be placed in the NRC Public Document Room (PDR).

Sincerely,

Original Signed By:

Richard J. Conte, Chief
Reactor Projects Branch #8
Division of Reactor Projects

Docket No. 50-213
License No. DPR-61

Enclosure:
NRC Inspection Report No. 50-213/97-05

cc w/encl:
B. Kenyon, President and Chief Executive Officer
D. Goebel Vice President - Nuclear Oversight
F. Rothen, Vice President - Nuclear Work Services
D. Amerine, Vice President, Nuclear Engineering and Support
L. Cuoco, Senior Nuclear Counsel
G. van Noordennen, Manager, Nuclear Licensing
R. Johannes, Director - Nuclear Training
J. Smith, Manager, Operator Training
W. Meinert, Nuclear Engineer
R. Bassilakis, Citizens Awareness Network
J. Block, Attorney for CAN
J. Brooks, CT Attorney General Office
M. DeBold, Town of Haddam
State of Connecticut SLO

Distribution w/encl:
Region I Docket Room (with concurrences)
PUBLIC
Nuclear Safety Information Center (NSIC)
NRC Resident Inspector
H. Miller, RA\W. Axelson, DRA
D. Screnci, PAO
R. Conte, DRP
M. Conner, DRP
C. O'Daniell, DRP
J. White, DRS

Distribution w/encl **(VIA E-MAIL)**:
K. Kennedy, OEDO
S. Weiss, NRR, DRPM, PDND
M. Fairtile, PM, NRR
M. Callahan, OCA
W. Travers, SPO
R. Correia, NRR
F. Talbot, NRR
R. Zimmerman, ADPR, NRR
J. Goldberg, OGC (LFD, AEN)
J. Lieberman, OE (OEMAIL)
D. Holody, EO, RI
DOCDESK
Inspection Program Branch, NRR (IPAS)

DOCUMENT NAME: g:\branch8\1-hn\97-05.rpt
To receive a copy of this document, indicate in the box: "**C**" = Copy without attachment/enclosure "**E**" = Copy with attachment/enclosure "**N**" = No copy

OFFICE	RI/DRP		RI/DRP					
NAME	CONTE		WHITE					
DATE	11/ /97		11/ /97		/ /97		/ /97	

OFFICIAL RECORD COPY

U.S. NUCLEAR REGULATORY COMMISSION
REGION I

Docket No.: 50-213

License No.: DPR-61

Report No.: 50-213/97-05

Licensee: Connecticut Yankee Atomic Power Company
P. O. Box 270
Hartford, CT 06141-0270

Facility: Haddam Neck Station

Location: Haddam, Connecticut

Dates: July 8 - October 6, 1997

Inspectors: William J. Raymond, Senior Resident Inspector
Dr. Jason Jang, Senior Radiation Specialist
Eben L. Connor, Project Engineer
Morton B. Fairtile, Project Manager

Approved by: Richard J. Conte, Chief, Projects Branch 8
Division of Reactor Projects

EXECUTIVE SUMMARY

Haddam Neck Station
NRC Inspection Report No. 50-213/97-05

This integrated inspection included aspects of decommissioning operations and planning. The report covers a three month period of resident inspection, and the reviews by regional and headquarters inspectors in the areas of operations, engineering and plant support.

Plant Operations:

Performance varied in the quality of plant operations. Operators performed duties well to maintain spent fuel cooling, to monitor the status of the spent fuel, and to respond to deficiencies that challenged spent fuel cooling. Events and human performance errors challenged operators and hampered the ability to monitor and control plant conditions. Exceptions to good performance were noted in some informal practices (poor communications and the unreviewed actions to de-energize circuits). Inadequate procedures hampered operator response to off normal conditions. Shortages were noted in operator staffing and the availability of qualified personnel.

Maintenance:

Plant personnel performed well to address problems, including the troubleshooting and repair of the emergency diesel generator EG-2A shutdown circuit. Plant personnel completed routine tests of plant equipment well, recognized degraded conditions, and initiated actions to complete troubleshooting and repairs. Good work controls were noted, including good pre-job briefs, control of tags, and adherence to work packages. Actions to maintain the operable portions of the seismic monitoring system and to initiate design work to replace the system entirely were acceptable.

Engineering:

Engineering provided effective support to plant operations and decommissioning planning during the period. A good regard for spent fuel safety was noted in the actions to address beyond design basis events for the spent fuel pool. Mixed performance was noted in licensee actions to meet NRC commitments, and to make timely reports. The effectiveness of actions to address these process weaknesses remains to be demonstrated. The licensee was working to implement Bulletin 94-01 for the spent fuel pool. For those portions of the program completed, the licensee's controls were adequate. An open item will track NRC review of the bulletin actions, and the liner leakage monitoring program.

Plant Support

NRC review of offsite contamination surveys continued, along with an assessment of past practices for handling potentially contaminated materials and fill from the site. Licensee practices to process environmental samples in the onsite counting laboratory were poor, as was the communication of preliminary results for sample 9608. The radiological controls for routine work was acceptable. The corrective actions to address weaknesses in the program to calibrate the radiation monitoring system were well conceived and executed. NRC review of this matter was in progress.

TABLE OF CONTENTS

REPORT DETAILS

Summary of Plant Status

The Haddam Neck plant conditions remained stable with the spent fuel safely stored in the spent fuel pool. The licensee maintained controls to keep the fuel adequately cooled. There were no significant changes in the plant systems not required to support spent fuel cooling. The licensee submitted the post shutdown decommissioning activity report, and continued to plan decommissioning activities.

NRC inspections during the period included the reviews by the resident inspector of post operating activities, and the preparations for decommissioning. A special inspection was conducted of an inadvertent actuation of the halon system in the control room on August 7, which resulted in the temporary evacuation of the control room and the declaration of an Unusual Event emergency classification. A special review was conducted of the issues identified in NRC Bulletin 94-01 for the control of spent fuel pools.

NRC activities at the site included plant tours: on July 21-25, by Messrs. Mort Fairtile and T. Fredericks of the NRR Office of Decommissioning Projects; on July 29-30, by Mr. Richard Conte, Chief of Reactor Projects Branch #8; and, on September 18-19, by Mr. William Axelson, Deputy Regional Administrator and Mr. John White, Chief of the Radiation Safety Branch. NRC personnel attended a meeting of the Community Decommissioning Advisory Committee on July 29, 1997.

I. Operations

O1 Conduct of Operations[1]

Using Inspection Procedure 71707, the inspector conducted periodic reviews of plant status and ongoing operations. Operator actions were reviewed during periodic plant tours to determine whether operating activities were consistent with the procedures in effect, including the alarm response procedures.

O1.1 Operating Activities and Status of Operating Systems

a. Inspection Scope (71707)

The purpose of this inspection was to review the licensee activities to maintain the plant in the defueled condition, and to prepare for decommissioning activities.

b. Observations and Findings

Operating activities during this period included those operations needed to maintain stable plant conditions with the reactor defueled, to maintain adequate level in the

[1] Topical headings such as O1, M8, etc., are used in accordance with the NRC standardized reactor inspection report outline. Individual reports are not expected to address all outline topics.

spent fuel pool, and to assure adequate cooling of the spent fuel. Service water, component cooling water and closed cooling water pumps were operated as needed to support spent fuel pool cooling. The operating closed cooling water (CLW) pump was lost temporarily on September 18, as described in Section O1.3 below. The normal and emergency electric distribution system remained in service.

The number of control board annunciators that remained illuminated was reduced from about 100 to 50 as the licensee implemented NOP 2.0-9, Disposition of Control Room and Local Panel Annunciators. This action partially addresses the concerns identified in Inspection Item **97-01-01**, which will remain open pending further review of the implementation of NOP 2.0-9. Operator responses to off normal conditions were consistent with the applicable procedures.

The inspector observed operator actions for several activities during the period, and reviewed operator adherence to procedures. The operating activities observed included: the response to an inadvertent halon system actuation on August 9; the response to a lightning strike on August 17; cleaning the B SFP heat exchanger on August 19 per NOP 2.10-1; the loss of the CLW system and the station air system on September 18; transferring water from the refueling water storage tank to the borated waste storage tank on October 8 per NOP 2.14-18; and, monitoring plant status in the defueled condition throughout the period.

Configuration Control and Tagging

The inspector reviewed the licensee's control of the physical configuration of the plant. Licensee actions to issue and/or remove tags under the following clearances were reviewed: 96-1102, 97-286, 97-292, 97-293 and 97-300. This review included the implementation of the tagging process during the conduct of work activities, and the control of systems removed from service due to plans to decommission the plant. No performance problems were noted.

Spent Fuel Cooling

The inspector reviewed licensee activities to assure compliance with Technical Specifications (TS) TS 3.9.11, SFP Water Level; and, TS 3.9.15, SFP Cooling. There were no activities during this period involving the movement of fuel or heavy loads over the spent fuel pool. The licensee conducted routine surveillance of the spent fuel pool and building, which included the tours by the nuclear side operators once each shift per SUR 5.1-0B.

The spent fuel pool cooling system (SFPCS) remained operating per normal operating procedures (NOP) 2.10-1. The SFPCS operated with at least one heat exchanger and one pump aligned to the pool. The licensee maintained pool temperature below the limit of 150 F per TS 3.9.15. The service water (SW) side of the SFP cooling system was maintained using either the normal SW piping or through a temporary bypass per NOP 2.24-3 during times when the normal cooling lines were not available.

As in the past, deficiencies in material conditions of service water components caused the licensee to take the service water supply to the SFP out of service, and to rely on temporary, alternate cooling supplies (fire hoses) to cool the spent fuel pool. The licensee followed TS 3.9.15 during the period from July 21 to August 18, 1997 as several deficiencies were addressed. The inspector also periodically reviewed license actions to meet the following requirements during the period: TS 3.3.3.3, TS 3.3.3.7, 3.3.3.8 and technical requirements manual (TRM) II.1.E and II.1.A. No inadequacies were identified.

c. Conclusions

Operators performance was good to monitor the status of operating plant equipment, and those systems in a lay up condition. Operators showed good regard plant procedures. Operators performed well to monitor the SFP and the SFPCS, and to use alternate cooling methods as actions were taken to address discrepant conditions. Several problems caused conditions that challenged the operators and the normal cooling supply for the spent fuel pool; operator response was good.

O1.2 Lightning Strike

a. Inspection Scope (71707, 93702)

The purpose of this inspection was to review the licensee activities following a lightning storm that affected plant equipment. The inspector responded to the site to verify plant status and review licensee actions.

b. Observations and Findings

With the plant shutdown and the reactor defueled, a lightning strike at the station at 2:07 a.m. on August 17, 1997 caused the loss of spent fuel pool cooling and tripped several plant components. The plant equipment affected included the trip of the operating A spent fuel pool cooling system (SFPCS) pump, the temporary loss of the plant process computer (PPC) and security lighting, the tripping of several ventilation system fans (control room, switchgear room, spent fuel building, turbine building, administration building), and the tripping of the operating A service air compressor and the sample pumps for stack high range monitor RM-14B. Numerous alarms were received in the control room and the security diesel generator started and assumed loads. The plant emergency diesels did not start and were not required since there was no loss of the 4KV or 480 volt emergency buses, which remained powered from the 115KV system.

Plant operators and security personnel responded to the event using abnormal and emergency response procedures to identify off normal equipment conditions and to restore normal equipment operation. Under voltage (uv) lockout relay 27-X5 tripped (which monitors 480 volt Buses 4, 5, 6, and 11), and caused the isolation of service water to the SFPCS. However, the 480 volt buses remained energized and no flags were noted on the individual bus uv relays. The PPC was restarted and functional by

2:21 a.m. Operators restarted the A SFP cooling pump, reset the 27-X5 relay, and restored cooling to the SFP by 2:25 a.m. Spent fuel pool temperature remained stable at about 100 degrees F. The operators reviewed plant equipment conditions and restored equipment affected by the voltage transient. Plant electricians assisted in a systematic review of all electrical buses and panels. No equipment damage was found. Equipment affected by the transient was restored.

The licensee long term review and follow-up of the event was provided by ACR 97-616 and by the engineering programs group. An engineering evaluation of plant equipment performance was provided by memorandum CY-TS-97-0497 dated October 3, 1997. Plant equipment operated as expected during the voltage transients, including the operation of the 27-X5 lockout relay, which operates by undervoltage relays on the 480 volt buses. The lockout relay operated without the loss of the 480 buses on undervoltage because of differences in sensitivity and operating settings of the relays.

c. Conclusions

Operators responded well in response to plant upset conditions caused by the lightning, and to quickly restore normal equipment conditions. Licensee follow-up actions were good to evaluate equipment performance and to plant systems operated properly.

O1.3 Loss of Closed Cooling Water (CLW)

a. Inspection Scope (71707)

The purpose of this inspection was to review the licensee activities following a loss of the operating closed cooling water system.

b. Observations and Findings

On September 18, 1997, the operators received a trouble alarm on the turbine building closed cooling water (CLW) system. The NSO found that the CLW pumps were cavitating due to an air leak into the system. The operators shutdown the CLW pumps to preclude damage, which left the station and control air systems (A station air compressor, and the A and C control air compressors) without any cooling. The applicable alarm response procedure, ANN 4.8-23B, was written for the full power operations condition, and directed the operator within 10 minutes to line up the well water system to supply cooling to the air compressors. The alternate CLW cooling mode would use a modified CLW valve lineup that resulted in an open path the discharge canal. The Shift Manager noted that the CLW contained chemically treated water and had recently been discovered to contain radioactive contamination (ACR 97-694, at levels of 3 X 10-7 μCi/ml). Thus, following the alarm procedure would have resulted in an unanalyzed and unmonitored discharge to the river. Since the alarm procedure was written to prevent a loss of station air with the plant operating at full power, a much more severe transient than with the plant in cold shutdown and

defueled, the SM directed the NSO to shutdown the operating air compressors. The operators use the guidance of EOP 3.1-34 to respond to a loss of station air at 9:15 a.m. on September 18.

The loss the station air caused the primary auxiliary building and radwaste building fans to shutdown because the air operated pressure instruments caused the purge fans to trip. Actions were taken to monitor building pressure and airborne radioactivity. The loss of air caused the flow controller for the nitrogen supply to the waste gas system to fail open, which resulted in an uncontrolled pressurization of the waste gas surge tank (WGST) tank. The WGST pressure remained below the lift setpoint of the relief valves since the nitrogen supply bottles were almost empty. This event was a precursor event because, had the nitrogen supply tanks been full, the event would have resulted in the pressurization of the WGST to the lift setpoint, in an unplanned release of the WGST. The tank contained one year decayed fission gases and nitrogen. The diesel generator fire pump fuel tank level instrument depended on control air and failed. The lack of level indication did not affect pump operability. There was no other impact on plant operations. The event did not affect the spent fuel pool cooling system, since the service water return valve SW-AOV-9, was designed to fail-as-is on loss of air. There was no change in SFP temperature during the transient.

The operators restored the ventilation system to normal. Subsequent investigations of the service and controlled air systems found the CLW system became air bound because of a leak in the A SAC aftercooler. The operators isolated all CACs and SACs operating at the start of the event, vented and started the CLW system at 12:25 p.m., and started the unaffected B SAC. Control and service air supplies were restored to the station at 1:50 p.m. and plant ventilation systems were returned to normal. ACRs 97-764 and 97-765 were written to address the loss of CLW and the inadequate procedures issues, respectively.

The licensee subsequently completed a controlled release of the WGSTs and discontinued use of the waste gas system. This action eliminated the potential waste gas system vulnerability to a loss of station air.

c. Conclusions

The operators responded well to the degraded plant conditions. The SM decision to avoid an unplanned release via the liquid pathway was good in consideration of the defueled condition of the plant and the expected minor plant response to a loss of air. However, the operators did not anticipate the impact of the loss of air on the waste gas system. Plant procedures contained inappropriate directions assuming a plant power operations condition, and hampered the operator response to the event. The inadequate procedures created a vulnerability to an inadvertent waste gas release. This is another example of procedures inadequacies for the shutdown condition. See Section O3.1 below for further NRC review of this matter.

O1.4 Inadvertent Control Room Halon Actuation (IFI 97-05-01)

a. Inspection Scope

The purpose of this inspection was to review the inadvertent actuation of the halon system on August 7, 1997, which resulted in the evacuation of the main control room at 9:47. The control room was remanned at 10:34 a.m. The inspector was notified of the event by a call from the Shift Manager at 10:20 a.m. and responded to the plant at 11:30 a.m. to review plant status and licensee actions.

b. Observations and Findings

Plant Status

At the time of the event, the plant was shutdown with all nuclear fuel stored in the spent fuel pool. The spent fuel pool (SFP) cooling system was in operation with the A SFP cooling pump in service aligned to the B heat exchanger. Spent fuel pool temperature was at 94 degrees F, which did not change during the event.

At the time of the event, the following personnel and activities were in progress in the control room: a Shift Manager (SRO) and two licensed operators, the normal shift complement, were performing routine duties; an electrician was stationed at the fire detection system (FDS) panel, working with a second electrician conducting tests of smoke detectors in the auxiliary feedwater pump room per TRM 16.9-51; two generation system test (GTS) personnel were working on the SCADA supervisory panel for the offsite electrical distribution system; and, a training department representative was taking pictures of fire system panels to develop training aids.

Halon System Discharge

The time line for major events, provided in Attachment I, was developed by the licensee and validated by the inspector. The sequence was reconstructed from control room annunciator and access door card reader event logs and personnel briefings after the event.

The training representative took pictures of the ANSUL Autopulse 2000 Halon control panel mounted on the wall in the southwest corner of the control room. The pictures were for an upgrade of the Fire Protection - Control Room Halon System training manual. He was using a digital Canon PSI001, Power Shot 600 camera. The trainer had opened the door of the halon control panel to photograph the alarm reset/silence pushbuttons located on a printed circuit board (PCB) inside the panel.

On taking the first picture with automatic flash, a small annunciator mounted in the PCB began beeping and continued until he closed the panel door (probably two or three beeps). The trainer talked with the operator and both returned to the halon fire control panel to review what had caused the alarm. The operator and trainer checked with the electrician to determine that none of the FDS test activities caused

the alarm. The electrician stated he recalled that photography in the past had caused alarms on the fire system. The operator noted the condition and intended to file an adverse condition report to document the alarm condition for further investigation. The trainer proceeded to take additional pictures.

On taking the second picture with automatic flash, the Halon system went into an immediate full alarm condition and a complete discharge of Halon through discharge nozzles located throughout the control room envelope (9:47 a.m.). The alarm was generated on Halon system annunciator and strobe flash warning lights mounted on the control room walls, which went into a continuous wail. The alarm system did not provide the expected 60 second warning of immediate Halon discharge. The Halon discharged in about 15 seconds rapidly filled the room with Halon fog. The high velocity discharge blew papers around the room, and knocked several ceiling tiles loose. Three plexiglass light panels were knocked out of the ceiling fixtures, and assorted pieces of ceiling panel support steel was pushed up or knocked loose. A falling ceiling panel support steel broke the cover glass and bent the case fastener on relay 85-M2, which provided backup line protection to 345KV line 12R-320.

Operator Response

The operators and other personnel, startled by the unexpected discharge and rapidly decreasing visibility, immediately withdrew from the control room (9:47 a.m.) to the access foyer and communications room or the turbine hall immediately adjoining the control room. The precautionary evacuation was completed in less than one minute. Both the foyer and communications room have large windows allowing full view of the control room proper.

The Shift Manager (SM) assessed the events leading to the halon discharge and plant conditions. Other than the halon discharge, there was no indication of a fire. Based on their training, the operators knew that halon by itself was not immediately life threatening and short duration exposures could be endured. The SM and licensed operator immediately reentered the control room with the halon concentration at its maximum value to assure all personnel had evacuated and to complete a sweep of the room to verify there was no fire. The GTS personnel met the operators at the control room access door exiting the room. The SM again walked through the control room, including the front section, the back panel areas and the interior to the control panels, to verify there was no indication of fire, and that all personnel had evacuated. The operating staff then withdrew to the access foyer and communications room.

The Shift Manager considered what procedures applied to the situation and to formulate a plan of action. The following procedures were considered:

- AOP 3.2-50, Operations from Outside the Control Room, was in a "Do Not Use" status since it prescribed actions that assumed the reactor was operating at full power and directed actions from shutdown panels with controls and indicators for systems no longer in operation for a defueled plant and which provided no information for systems required for SFP cooling.

- AOP 3.2-57, Station Fires, was also considered, but not entered because it was not fully applicable. Even though the halon system actuation was one of the entry conditions for the procedure (Symptom 2.4), the Shift Manager had verified that no indications of fire was present, and the halon actuation was related to the photography of the control panel.

- AOP 3.2-7, Loss of Fire Systems was deemed applicable and was entered to compensate for the inoperable Halon fire system. The operators took actions to implement compensatory measures per the technical requirements manual (TRM) for the inoperable fire system, to reset the Halon system, and to place the control room ventilation in the normal mode to clear the Halon from the room.

The operators concluded that except for AOP 3.2-7, plant procedures did not address the conditions and responded to the event using their knowledge and experience. The response actions were to account for personnel, secure and disable the halon system, initiate the ventilation system and check air quality to regain unrestricted access to the control room. The operators re-entered the control room briefly as necessary to obtain procedures and respond to alarm (only one came in on FDS-2 as a result of the testing in progress). Additional support was requested and received from management and support personnel, who assisted in the event classification and notifications. Further inspector review of the procedures is provided in Section O3.1 below.

The Shift Manager and operators remained stationed in the adjoining rooms to monitor the status of the control boards. Through the use of the viewing windows, the operators had view of the FDS status panel, the 115 kv and 345 KV and inplant electrical distribution system, the status of the operating service and component cooling water pump, and the status of the area and process radiation monitors. The control room annunciators were visible, including those on panel E1 for SFP temperature and level.

An auxiliary operator was sent to the spent fuel pool to verify pool level, and the operators completed a second set of rounds to verify there were no undetected changes in plant conditions. Following the completion of air quality checks, the operators re-manned the control room at 10:34 a.m. The licensee entered the action statement for TRM II.1.E 3.1.b for the inoperable halon system and maintained a compensatory measure that assures a continuous fire watch was posted in the control room.

Event Classification and Emergency Declaration

The Shift Manager considered the available emergency actions levels (EALs) and noted no symptoms specific EAL exactly applied to the plant status and conditions.

EAL GA-1 would have required an Alert classification had the control room been evacuated and AOP 3.2-57 had been entered due to an actual fire. The operators had not entered AOP 3.2-57, and although the operators had left the control room, the panels were monitored and the room was accessible as needed to respond to alarms. The plant conditions did not meet the general event classification criteria for an Alert of "events in progress representing an actual or potential degradation in plant safety," since the spent fuel was cooled and not affected by the event.

The Shift Manager classified and declared an Unusual Event at 10:45 a.m. based on EAL JU-1, DSEO Judgement: any condition which indicates a potential degradation in the level of safety of the plant. The NRC Duty Officer was notified per 50.72(a)(1)(I) at 10:53 a.m. The Unusual Event was terminated at 12:35 p.m. after confirming stable plant conditions, completing habitability surveys and resuming normal manning of the control room and SAS.

The time frame for classifying the event did not meet licensee performance expectations. The event was classified in 51 minutes after symptoms appear that warrant classification versus the expected 15 minutes. This matter was noted for further licensee follow-up. The inspector reviewed EPIP 1.5-1, 1.5-2, and 1.5-3 regarding event evaluation, classification and notifications. No other deficiencies were identified.

Security Response

The central alarm station (CAS) was affected by the event. The CAS operator tried to contact the control room. No one was reached since the control room had been evacuated momentarily. Security personnel evacuated the CAS at 9:53 a.m. Security compensatory measures were implemented. A security supervisor entered the CAS with self-contained breathing apparatus (SCBA). The security force remained focused on plant security. The security supervisor was qualified for fire brigade duty and to use the SCBA. Following the completion of air quality checks, the guards resumed normal manning of the CAS at 10:33 a.m.

Management Response

The Unit Director convened a meeting of the management team to review the event, assess plant status, and make assignments to follow-up the event. The Director concurred at 12:30 p.m. with the plans and actions to terminate from the Unusual Event based on an assessment that plant conditions were stable and follow-up habitability surveys were acceptable. An Event Review Team was chartered to review and determine the event cause and to develop recommendations for further actions. Other licensee evaluations and follow-up action were described in ACR 97-570. The

licensee reported this event to the NRC in voluntary licensee event report LER 97-13. The follow-up actions included:

- A walkdown of the control room was completed to assess conditions and the impact on electrical equipment, and structural damage. Only minor damage was noted. Actions were taken to correct material deficiencies, and to support halon system operability.

- Based on the apparent cause, all fire system control panels in the plant were posted to warn personnel that "photography is prohibited inside the cabinets". The inspector independently verified the caution tags were hung and signs were posted as intended. The licensee completed a review to determine what other systems used digital components that might be similarly affected by flash photography.

- Tags blew off the panels during the discharge were rehung: the panels were reviewed to verify affected tagouts were correctly restored.

- The site nurse conducted a medical assessment of personnel exposed to halon and identified no acute affects: the material safety data sheets (MSDS) and halon manufacturer were contacted to determine what the toxicity effects were and whether further medical assessment (blood work) was recommended. No adverse effects were expected based on a 5% to 7% halon concentration derived to the control envelope (system design basis) and for continuous exposures up to 15 minutes.

- Actions were taken to inspect and clean the detectors, recharge the halon bottles and test the system. The licensee also considered whether technical and regulatory requirements required the continued use of the halon system for fire suppression (since the requirements of 10 CFR 50, Appendix R no longer applied to the plant due to the decision to enter decommissioning).

- The licensee Event Review Team completed further testing on August 7 following the event, in which conditions were recreated to take photographs of the Autopulse 2000 control panel. The test showed that the halon system actuated in response to the flash photography. When a picture was taken without the flash, the system showed no response. The test was conducted twice with the same results. No discharge occurred since the halon bottles were empty.

Root Cause Investigation

The licensee conducted additional testing and root cause investigations to determine why the halon actuation occurred, and in the sequence observed. Technical Programs personnel provided extensive engineering support for this effort. The inspector observed additional testing during the week of August 25 conducted insitu

on the halon panel with the system functional but rendered incapable of injecting halon.

The Autopulse 2000 control panel has a processor control board containing a microprocessor based logic, database, memory, field terminals, auxiliary relays and switches. The inputs from the detectors are monitored by the microprocessor which contains the programmable logic to receive the sensor inputs, generate the time delays for the reaction warnings, and generate the signals actuate the Halon discharge and the alarms. The microprocessor is sensitive to electromagnetic (EMI) and radio frequency (RFI) interference in that the signals can actuate affect the processor outputs, including the generation of an actuation signal down stream of the time delay circuit. This has been noted by several similar events in the industry, including one at another power plant on February 4, 1997. An almost identical event occurred when flash photography of a Chemetron Micro 1-EV control panel in the Relay Room caused the ventilation system to isolate and the CO_2 to charge to the local isolation valve.

The results of the Event Review Team investigations and evaluations were provided in a report on September 17, 1997 (CT-TS-97-0550). The licensee concluded that the cause for the August 7 halon actuation was that the Autopulse 2000 EPROM reacted to the camera flash. Testing showed that neither EMI nor RFI was a contributor. As a corrective action to address this, the licensee temporarily installed electrical tape over the EPROM window to assure it would be shielded from this type of light. This control was subsequently made permanent as a bypass jumper (97-06). The licensee also evaluated the vulnerability of other systems that have EPROM circuits (such as fire protection and auxiliary feedwater controls).

The ERT evaluations identified other items to improve performance that were addressed in nine recommended corrective actions. The findings included issues related to procedures, communications, emergency plan notifications, human performance errors and the application of the “STAR” process, dissemination of industry information, procedure adequacy, and guidance on the use of self-contained breathing apparatus. The licensee actions to address these matters will be followed in subsequent NRC inspections (**IFI 97-05-01**).

The licensee's critique of the event identified the failure by control room personnel to notify the CAS about the evacuation, and included this issue in the evaluation of the incident. The licensee also noted other inadequacies in communications amongst the operators and between the operators and the training representative. The halon actuation might have been prevented had these communications been more thorough and deliberate.

The licensee remained in the action statement for TRM II.1.E as of the conclusion of this inspection, pending the completion of actions to return the halon system to operation.

c. Conclusions

Operators responded well to the inadvertent actuation to monitor plant system status, assure personnel safety, and to mitigate the event. The guard force performance was good to remain focused on plant security. Station management provided good support to the operators to assist in event classification and notifications, and to assign resources for long term follow-up and event evaluation. Engineering evaluations were timely and thorough to investigate the cause of the event, identify recommendations to improve performance and identify corrective actions. Station procedures contained references to power operating conditions and did not provide for shutdown condition, and hampered the operator response to the event.

O3 Operations Procedures and Documentation

O3.1 Procedures for Shutdown Operations (URI 97-05-02)

a. Inspection Scope (IP 42700)

The purpose of this inspection was to review plant procedures governing operations in a shutdown and defueled condition. The review also focused on procedures for shutdown from outside the control room conducted in follow-up to the August 7 halon actuation event.

b. Observations and Findings

AOP 3.2-59, Loss of Spent Fuel Cooling

The inspector reviewed this procedure to validate the licensee changes (TPC 97-281) following the decision to remove the refueling water storage tank from service. The licensee planned to drain the tank and to repair the tank bottom to stop a chronic leak of tritium from the tank. The procedure change was made to substitute the use of the demineralized water storage tank (DWST) as a backup source of makeup water to the spent fuel pool (reference safety evaluation SE-EV-97-103). AOP 3.2-59, Attachment 11 was written to describe the method for transferring DWST water to the pool. The inspector reviewed plant drawings, interviewed operators and walked down the procedure in the field to verify that the procedure methodology would work and that the procedure would work as written. No inadequacies were identified.

AOP 3.2-50, Shutdown from Outside the Control Room

The inspector reviewed procedure for plant shutdown from outside the control room, AOP 3.2-50, which included a walkdown in the plant with an operator. This review confirmed that the procedure could not be performed as written, in part, because of references to actions for plant conditions that no longer existed in the shutdown condition. Although the remote shutdown panel was still energized, the controls and indications provided there were for systems that either were not operating or not useful for monitoring the spent fuel pool or the spent fuel cooling system. Procedure steps for combating an actual station fire were also provided in the procedure for

station fires, AOP 3.2-57. The inspector concluded that there would have been no benefit for the operators to have manned the remote shutdown panel.

The inspector concluded that the procedures available at the time of the event did not help the operators mitigate the event. There was no guidance on how to respond to an inadvertent halon actuation (ANN 4.23-1, AOP 3.2-57). Procedures in the active status (AOP 3.2-57) referenced procedures in the "DO NOT USE" status (AOP 3.2-50). AOP 3.2-57 contains some steps (tripping the reactor) that are no longer applicable to the defuel condition and should be revised to reflect the decommissioning status of the plant. When outside the control room, the operators did not have ready access to procedures, and obtained copies of procedures by re-entering the control room. The operators need additional procedures for recovery from events like those on August 7, and for actions outside the control room.

The procedure for classifying events, EPIP 1.5-1, did not have a specific EAL to help the operator classify the event for the shutdown and defueled condition of the plant. The inspector identified that the licensee administrative controls for procedure usage did not address the operator rules of use for AOPs. The licensee acknowledged this finding and issued ACP 1.2-6.22 to address this area. The inspector concluded deficiencies existed in the procedures for shutdown operations which hampered the operator response to the halon event.

Quality of Procedures

The adequacy of plant procedures has been a past NRC concerns (reference Inspection 96-10, 97-01 and 97-03). The inspector met with Operations personnel to review the status of the efforts to revise procedures for shutdown operations. The licensee status list shows a number of procedures in several categories that still require revision: convert 4 EOPs to AOPs; and change 7 AOPs to eliminate references to power operations or other wise make current for permanent shutdown operations). Numerous other system and normal operating procedures require revision to reflect permanent shutdown status. While station Key Performance Indicators show some reductions in the procedure revision backlog since March 1997, progress had been hampered by the lack of operations and engineering resources to revise and review procedures, respectively.

As described in Section O1.4 above, other procedure deficiencies for the shut down operations hampered the operator in the response to events. The following ACRs were issued by the plant staff during the period and show concerns regarding procedure adequacy in broad areas of plant activities: 97-605, 606, 607, 612, 626, 607, 691, 688, 689, 697, 701, 710, 724, 741, 749, 764 and 765. Licensee actions for each individual discrepancy were appropriate. This item is unresolved pending the completion of actions to revise procedures for decommissioning operations, and subsequent review by the NRC **(URI 97-05-02)**.

c. Conclusions

Although the licensee had initiated procedure reviews and revisions for shutdown conditions, procedures contained inappropriate references to power operations conditions and hampered operator responses to events in the defueled condition. The availability of adequate resources impacted the timeliness of revising procedures for shutdown operations. While licensee actions to address individual procedure issues were appropriate, the findings indicate the need for continued licensee actions to address procedure quality for shutdown operations.

O3.2 Logs for Radwaste Operations

The inspector reviewed the requirements for record retention and the licensee practices for maintaining logs of radwaste system operations.

A hard bound log book is maintained at the auxiliary operator desk opposite the radwaste panel on the first floor of the primary auxiliary building. The inspector reviewed the log periodically during routine inspections of operating activities and noted that the log typically was used to provide a narrative description of radwaste activities, including a record of waste transfers and releases.

The inspector noted that the licensee practice was to discard the log book when full, and thus, past copies of the log book were no longer available for review. The inspector reviewed this practice for compliance with the record retention requirements in Technical Specification 6.10. The only applicable requirement was stated in TS 6.10.3.e, which requires that the licensee maintain for the duration of the facility operating license..."records of gaseous and liquid radioactive materials released to the environment". The inspector requested the licensee to demonstrate how the requirements of TS 6.10.3.e were met without the radwaste log.

The Operations Manager responded that the Shift Manager and control room logs, together with the radioactive discharge permits, were the official plant records used to comply with TS 6.10.3.e. Management expectations for log keeping were provided in procedures NOP 2.0-2 and ODI #1. The inspector reviewed both the radwaste and Shift Manager logs for typical operating activities covering the period from July 13 - 30, 1997, and noted that both logs contained entries for the radwaste operations. The inspector also noted, based on past routine reviews of operating activities, that the control room logs contained entries regarding plant effluents made under the approval of discharge permits. The licensee stated that maintenance of the radwaste log was an initiative and was not required to meet record retention requirements.

c. Conclusions

Licensee practices regarding the maintenance of records for radioactive effluents released to the environment met the requirements of TS 6.10.E.3.

O4 Operator Knowledge and Performance

O4.1 Operator Errors During Routine Duties

While operators performed routine duties generally well during this inspection period (See Sections O1.1 and O1.2 above), exceptions to good performance were noted. The following human errors challenged stable plant conditions, and operator control of the plant.

One exception to good performance occurred on September 20 when an operator manipulated with wrong breaker on 480 volt Bus 4. The nuclear side operator (NSO) attempted to close the breaker for the A service air compressor in response to directions from the control room operator. The NSO initially identified the correct breaker, but tripped the supply breaker for motor control center (MCC) - 9. The error caused the loss of the radwaste ventilation system and other minor loads. The error was recognized and corrected immediately. There were no adverse radiological consequences or operational affects on spent fuel cooling due to the event. The licensee documented this event in adverse condition report ACR 97-772; corrective actions were appropriate.

A second instance of poor performance was discovered on August 9 when operators attempted to pump down the containment sump, but were prevented due to the existence of a containment isolation signal that prevented the sump pump discharge valves from opening. The containment isolation signal was in effect because the high containment pressure (HCP) relays were tripped (ACR 97-583). Further investigation determined that the HCP relays were inadvertently actuated on July 30, 1997 when operators turned off circuits to equipment no longer in service, which included the vital 120 volt AC circuits powering the HAP circuits in the A1 and A2 reactor protection system cabinets. The licensee concluded the event occurred as a result of operator error in making the unreviewed and uncontrolled changes in the plant configuration. The licensee reported the inadvertent containment actuation to the NRC per 50.72(b)(2)(ii) on August 8, 1997, and as licensee event report LER 97-14 on September 5, 1997. The inspector reviewed the control room indications of the HCP actuation and determined that, once the isolation signal was generated, none of the subsequent checks routinely performed by the operator could have discovered the condition prior to the activities on August 9 to pump the sump. There were no adverse safety consequences of this event for the defueled plant conditions. Licensee corrective actions were appropriate.

The above human performance errors appear as additional examples of concerns previously identified by the NRC (reference Inspection Item EA 97-366 issued October 7, 1997). Licensee corrective actions to address personnel errors were in progress at the conclusion of this inspection. The licensee completed a common cause evaluation (CCE) of personnel errors (in response to ACR 97-444), which was completed on September 5, 1997. The CCE identified 7 contributing causes for personnel errors, and made four recommendations to reduce errors. Licensee actions to address this matter were in progress, and will be reviewed as part of the NRC follow-up to Inspection Item EA97-366.

c. Conclusions

Human performance errors and informal operational practices caused events that challenged operations. The effectiveness of licensee actions to reduce personnel errors remains to be demonstrated.

O6 Operations Organization and Administration

O6.1 Operator Staffing and Work Hours

a. Inspection Scope

The purpose of this inspection was to review the licensee actions to provide operator resources for plant activities.

b. Observations and Findings

The operations department staffing remained sufficient during this inspection period to staff 5 four-person crews on a rotating shift schedule. Each shift had 1 senior reactor operator/shift manager (SM), 1 reactor operator/control operator (CO), and 2 non-licensed operators/nuclear side operators (NSO). The staffing plan met the requirements of Technical Specification 6.2.2 for the requirements for Mode 6 - refueling. Additional anticipated transfers of operators expected by the end of 1997 would further reduce the number of qualified, experienced operators. The reductions in qualified operators became a factor in the licensee's planning for decommissioning activities, and contributed to the consideration of alternative methods to conduct the full reactor coolant system decontamination (planned use of the reactor coolant pumps was abandoned in favor of simpler operational methods to flush the loops).

The reductions in operator staffing and additional duties caused by the need for compensatory measures (fire watches) for degraded fire systems, resulted in the need for the routine use of overtime by the operators. The inspector reviewed the overtime worked by the operators during the period of July 16 - October 1, 1997, and noted that hours worked in excess of the administrative guidelines (reference TS 6.2.2.f) were approved in accordance with administrative procedure NGP 1.09.

The operator staffing shortages and the chronic use of high work hours provided stress on the operators, as described in several ACRs, including 97-665, 767, 700, 742, 739, and 767. The licensee had hired several contractor personnel for use as auxiliary operators (log keepers), but actions were in progress at the conclusion of this inspection period to fully train and qualify these individuals.

c. Conclusions

Reduced staffing in operations resulted in the chronic use of excessive overtime. The lack of qualified operators was a factor in decommissioning planning. The effectiveness of licensee actions to address this area remain to be demonstrated.

O8 Miscellaneous Operations Issues

O8.1 Conclusions for Operations

Performance varied in the quality of plant operations. Operators performed routine duties well to maintain spent fuel cooling and to monitor the status of the spent fuel. Operators responded well to events or deficiencies that challenged spent fuel cooling. Events and human performance errors challenged operators and hampered the ability to monitor and control plant conditions. Exceptions to good performance were noted in some informal practices (poor communications and the unreviewed actions to de-energize circuits). Inadequate procedures for decommissioning status of the plant hampered operator response to off normal conditions. Shortages were noted in operator staffing and the availability of qualified personnel.

II. Maintenance

M1 Conduct of Maintenance

Inspection Scope

Using Inspection Procedure 71707, 61726 and 62707, the inspector conducted periodic reviews of plant status and ongoing maintenance and surveillance. The inspector reviewed licensee activities to test, troubleshoot and repair plant equipment, and to address emerging conditions.

M1.1 Maintenance and Surveillance Activities

During the inspection period, the inspector observed licensee activities to maintain and test plant equipment necessary to support the spent fuel pool and spent fuel pool cooling system, and to assure the operability of support systems, such as the service water, process and effluent radiation monitoring, fuel oil, fire protection, ventilation, AC and DC electrical distribution, and the emergency diesel generator systems. During periods of degraded equipment performance, the inspector observed licensee actions to correct the problems, to implement compensatory measures, and to implement the requirements of action statements prescribed by the technical specifications and the technical requirements manual.

The inspector reviewed portions of the following work activities:

- test and repair of the emergency diesel generators
- replacement of letdown post filter FL-11-1A
- test and restoration of halon and fire detection systems
- test of the seismic monitoring instrumentation
- cleaning the B SFP heat exchanger
- testing the spent fuel building ventilation system
- testing of the diesel fire pumps
- packaging and shipment of new fuel (see Inspection 97-06)

- installation of the new fuel oil storage tank
- test and repair of several degraded SW valves in the SFP supply line (SW-V300, SW-V1412, SW-CV-963, SW-V238)

The inspector verified the licensee followed the action statement of TS 3.9.15 at various times during the inspection period when the spent fuel pool cooling system was declared inoperable in response to discrepancies associated with of service water system valve material conditions (SW-CV-963, SW-V300, SW-V-238), testing of SFP support systems (SW-CV-963), and SFP system design (single failure considerations). The inspector also periodically verified licensee actions to meet the required action statement for the following requirements during periods of degraded equipment performance: TS 3.3.3.3 for the seismic monitor; TS 3.3.3.7 and 3.3.3.8 for the radiation monitoring systems (R18, R22, R14B); and fire protection technical requirements manual (TRM) II.1.E and II.1.A for the fire detection systems and the control room halon actuation system. No inadequacies were noted in the licensee responses to the degraded equipment conditions.

Maintenance personnel provide good support to operations in response to emerging conditions and following several events, such as the lightning strike at the facility, the restoration of the control room halon system, and the timely repair of degraded conditions in the SW supply to the spent fuel cooling system. The industrial safety reviews and topple analysis (reference memorandum CY-TS-97-0401) to install the new fuel oil storage tank were thorough to assure the work would not adversely impact plant or worker safety.

Seismic Monitor

The RSA-50 seismic monitor system remained degraded due to a failure of the data play back system. Spare parts were not available due to the age of the system. Four of the five system components remained operable and capable of recording a seismic event at the station, including: the triaxial accelerometer, the digital cassette accelerograph, the seismic warning panel, and the SMR-102 playback system. The operable instrumentation would provide indication to control room operators that a seismic event has occurred, and a trace of the vibration time history would be recorded on tape for subsequent analysis offsite. The data that is not immediately available would be the instantaneous response spectrum comparisons, which would be and indicator of the magnitude of the event. This information would be available to the licensee from offsite (such as from Millstone or the Weston Geophysical Laboratory).

The licensee notified the NRC in accordance with TS 3.3.3.a on August 14, 1997 regarding the status of the seismic monitoring system and the plans to restore it to fully operational status. Engineering and design work was in progress at the conclusion of this inspection to completely replace the seismic monitoring system

M1.2 Deficient Material Conditions - SFP Cooling Supply

As in the past, deficient material conditions challenged the operators and affected the reliability of the normal cooling supply to the spent fuel pool. The deficient conditions caused the licensee to use alternate cooling for the spent fuel pool (fire hoses). The fire hoses were in service as the licensee completed piping repairs, modifications and test activities to address material discrepancies in the SW lines to the SFP heat exchangers. The inspector reviewed licensee actions during this period to address degraded conditions in service water system. The deficiencies were identified during the conduct of routine testing per SUR 5.7-217, or during troubleshooting and repair activities following that test. The deficiencies included the failure of SW-CV-963 to limit back leakage in the SW supply line to the SFP cooling system; the inability to meet test acceptance criteria for SW flow delivered to the SFPCS; the excessive leakage through SW isolation valve SW-V300; and, the mechanical failure (disk separated from stem) of SW isolation valve SW-V238.

The licensee took appropriate action to address each deficiency, including the replacement of valves, the use of improved flow measurement instrumentation, and revising the test methodology for the check valve test (discussed further below). Engineering and maintenance personnel provided good support to operations to investigate and evaluate the conditions, and to expeditiously address deficiencies to return the SFP cooling supply to normal configurations as soon as possible. The licensee improved the methodology to backwash the B SFP heat exchanger per NOP 2.10-1, which was successful in reducing the silt-induced fouling and provide some improvement in the heat transfer capacity.

During the routine quarterly test of SW-CV-963 on July 24, 1997, the check valve failed to meet the 2 gpm leakage criteria, causing the operators to declare the valve inoperable. The valve had been installed as a design change in April 1997 to eliminate the potential for waterhammer in the SW supply to the SFPCS during loss of normal power events. The licensee made an untimely 50.72 report of the issue as a condition outside the design basis (see Section E8.1 below), and submitted licensee event report LER 97-12 to describe the follow-up investigations and corrective actions. The apparent cause for the failed surveillance was a variation in the test methodology which presumable allowed debris to be back flushed into the seat area during system filling operations. The surveillance procedure was revised to assure debris could not be backflushed into the seat area. The check valve passed the test when this test deficiency was addressed; the next quarterly leak rate test was also successful. Although it was inconclusive whether the check valve was actually inoperable during the July 1997 test, the condition was conservatively reported per 50.73(a)(2)(ii) as a condition outside the design basis. Licensee actions to address this matter were effective and appropriate.

M1.3 Conclusions for Maintenance

Plant personnel performed well to address problems, including the troubleshooting and repair of the emergency diesel generator EG-2A shutdown circuit. Plant

personnel completed routine tests of plant equipment well, recognized degraded conditions, and initiated actions to complete troubleshooting and repairs. Good work controls were noted, including good pre-job briefs, control of tagouts, and adherence to work packages. Licensee actions to maintain the operable portions of the seismic monitoring system and to initiate design work to replace the system entirely were acceptable.

III. Engineering

E1 Conduct of Engineering

E1.1 Engineering Support for Operations and Decommissioning (URI 97-05-03)

Engineering provided effective support to plant operations during the period to address issues important to shutdown operations and decommissioning planning. In support of operations, engineering assisted in the successful resolution of: (I) the evaluation of surveillance tests and development of technical and safety evaluations (to improve the methodology for leak testing SW-CV-963 SY-EV-97-001, SY-EV-97-002 and SY-EV-97003); (ii) the development and implementation of detailed testing and root cause investigation of the control room halon actuation; (iii) the troubleshooting and repair of emergency diesel generator problems; (iv) the identification and prompt operability assessment of an anomalous operation of the spent fuel building ventilation system (a CMP finding - see ACR 97-680 and 810 below); (v) the development of revised cleaning methods to reduce fouling in the B SFP heat exchanger; (vi) the investigation of plant performance following a lightning strike (memorandum CY-TS-97-0497); (vii) the evaluation of the electrical distribution for spent fuel power supplies (ACR 97-457); (viii) the evaluation of backup water supplies for the spent fuel pool (SY-EV-97-103); and (ix) the completion of common cause evaluations for personnel errors and procedure adherence (CY-JDH-97-004).

In support of decommissioning, engineering: continued to implement the process in ENG 1.7-156 to categorize plant systems; made progress in the completion of decommissioning planning (GRPIs), particularly in the areas of calculations and analyses to support long term storage of spent fuel (see below); developed plans and procedures to remove a reactor coolant system artifact to use in the evaluation of decontamination solutions; and, developed revised procedures and made preparations to optimize the geometry of fuel stored in the spent fuel pool. Assessments and safety evaluations completed in support of operations and decommissioning activities were reviewed by the inspector while in progress and were technically sound and adequately documented.

The licensee submitted the Post Shutdown Decommissioning Activities Report on August 22, 1997, which initiated a 90 day period for the NRC staff to obtain public comments and to determine whether the report met the submittal requirements of 10 CFR 50.82.

SFB Ventilation

In support of reviews to define the licensing and design basis for the Spent Fuel Building Ventilation System, site engineering (Configuration Management Group) identified the need to test the system to obtain performance data. A test conducted during this period identified design deficiencies that constituted conditions outside the original design basis. These conditions were reported to the NRC per 50.72 on August 25, 1997 (ACR 97-680) and October 3, 1997 (ACR 97-810). The licensee found that the SFB exhaust fan could not deliver flow at the design condition of 13,000 cfm. Engineering completed timely operability assessments and investigated the causes for the discrepant conditions. The SFB fan performance deficiencies occurred as a result of a 1974 modification that replaced the original primary auxiliary building exhaust fans with higher capacity fans. The SFB exhaust flow decreased when the PAB fans operated since the SFB fan exhausted to the main stack via a ventilation path just downstream of the PAB fans. NRC review of this event was in progress at the conclusion of this inspection (**URI 97-05-03**).

SFP Calculations

The licensee completed additional analyses of the safety of the fuel; stored in the spent fuel pool, and showed good regard for plant safety by analyzing events considered beyond the design basis of the plant. By letter dated September 26, 1997 (CY-97-066), the licensee submitted for NRC review the results of an assessment of a loss of all water in the spent fuel pool. This assessment included calculations by the licensee's vendor, Holtec Report HI-971705. The calculations determined the date by which the fuel decay heat level would be reduced to the point that cladding temperatures would remain below the ignition point assuming all water was lost from the spent fuel pool. One assumption for this calculation was that the configuration of the stored fuel would be optimized to assure that the zircaloy clad fuel was interspersed amongst the stainless clad fuel and that the new racks would be used. Licensee actions were in progress at the conclusion of this inspection to optimize the pool configuration to meet the calculation assumptions. NRC:NRR review of the licensee's submittal was also in progress at the conclusion of the inspection.

E1.2 Follow-up on Enforcement Issues

Status of Previous Inspection Items

(Open) Violation 97-11-08, Failure to Report Inoperable Residual Heat Removal Pump. The licensee responded to this matter by letter dated February 13, 1997 (B16121) to describe the corrective actions to preclude recurrence. The licensee stated that additional guidance would be provided on performing operability and reportability evaluations. The guidance would include a requirement to consider a component inoperable whenever it is determined that the equipment was not maintained in such

a manner to assure its design basis. The licensee committed to revise procedures by June 30, 1997 to issue the new guidance.

The licensee identified a failure to meet its commitment in response to Item 96-11-08, as described in a letter to the NRC dated September 25, 1997 (CY-97-093). The action to address the violation was related to an action in response to LER 96-24, which was linked in the licensee's corrective action process. Subsequent to the February 1997 response, the licensee decided to split the reportability and operability processes, and to write separate procedures for each. The effort to was scheduled to be completed by September 30, 1997. The action to address the violation was linked to the September 30 effort, and the June 1997 commitment was overlooked. The licensee issued two new procedures on September 26, 1997: ACP 1.2-2.82, Operability Determinations; and ACP 1.2-2.44, Reportability Determinations and Licensee Event Report Processing. This item remains open pending completion of the licensee action to implement the operability and reportability guidance, and subsequent review by the NRC.

The licensee identified other weaknesses in its programs and processes to meet NRC commitments, as described in ACRs 97-753 and 97-779. In the June 11, 1997 response to the NRC's May 12, 1997 Enforcement Action and Civil Penalty and as part of the changes to improve corrective actions, the licensee committed to make new procedures include standardized causal factors codings to provide the necessary data to facilitate the recognition of programmatic or recurring causes and evaluate the effectiveness of corrective actions. This commitment was to be implemented by the second quarter of 1997, but was not done (ACR 97-753). Similarly, a QA audit identified that there is no formal process to incorporate NRC inspection commitments into station procedures, which resulted in the failure to incorporate Nuclear Oversight surveillance of radwaste processing activities on a monthly basis (ACR 97-779). In addition to the corrective action for these specific discrepancies, the licensee changed the tracking processes to give increased visibility to the tracking of NRC commitments. Those commitments already entered into the new Action Tracking System (ATS) were published and discussed weekly as part of the morning management meeting. Licensee actions were in progress at the conclusion of the inspection to better track items still in the Action Item Trending and Tracking System, and to issue a new procedure to enhance the process (ACP 1.2-2.62, Regulatory Commitment). The effectiveness of licensee actions in this area remains to be demonstrated.

Status of Corrective Actions for Escalated Enforcement

Licensee engineering and support staff completed several projects during period to support decommissioning projects and to address program and process weaknesses that were the subject of previous NRC violations. The licensee issued the Design Control Manual, along with a revised process to control the plant configuration. The Configuration Management Group completed the review and definition of the design and licensing basis for systems needed to support spent fuel storage and decommissioning. As reported previously, the licensee revised the corrective action

program and continued to implement the new process. Finally, the licensee revised the process to upgrade the UFSAR and issued two new sections internally. The licensee plans to submit a completely revised UFSAR to the NRC in December in 1997.

E1.3 Conclusions for Engineering Support

Engineering provided effective support to plant operations and decommissioning planning during the period. A good regard for spent fuel safety was noted in the actions to address beyond design basis events for the spent fuel pool. Mixed performance was noted in licensee actions to meet NRC commitments. The effectiveness of licensee actions to address process weaknesses to meet commitments remains to be demonstrated.

E2 Engineering Support of Facilities and Equipment

E2.1 Controls for Spent Fuel Pools - NRC Bulletin 94-01 (IFI 97-05-04)

a. Inspection Scope (73051)

The purpose of this inspection was to review the licensee controls for the spent fuel pool relative to the issues identified in NRC Bulletin 94-01. NRC Temporary Instruction TI 2561/002 was used for this review.

b. Observations and Findings

Background

On April 14, 1994, the NRC issued Bulletin 94-01 to nuclear plants permanently shut down by that date, in reaction to a potential spent fuel pool (SFP) drain down event caused by inadequate maintenance practices at Dresden Unit 1. At Dresden, a piping system, not connected to the spent fuel storage pool, experienced a frozen pipe that ruptured, and resulted in the loss of 55,000 gallons of water from the impacted system. There was a potential for a similar pipe rupture in systems communicating with the fuel pool. The bulletin required licensees of permanently shut down plants to verify that the SFP either was not susceptible to the Dresden event or to modify the SFP, supporting structures and systems to ensure against the Dresden event. While the Haddam Neck Plant was not shut down at that time, the licensee, after permanent shut down, took a prudent course of action and initiated a response to the bulletin. However, that response will not be completed until later in 1997.

The NRC issued Temporary Instruction 2561/002 (TI) that included an inspection program that addresses potential mechanisms that could lead to pool drainage and possible loss of integrity of stored spent fuel. The purpose of the TI is to provide NRC inspectors with guidance to enable assessment of the adequacy of protection provided for the storage of spent fuel. This was accomplished through inspections

of: (1) management oversight, (2) quality assurance, (3) fuel storage practices (foreign materials exclusion), (4) fire protection, (5) maintenance of fuel pool and its associated equipment, (6) fuel pool water chemistry, (7) siphon and freeze concerns and (8) training. Those portions of the TI covering the 1997 safety review program (10 CFR 50.59), emergency preparedness, and radiation protection were the subject of other inspections.

(1) Management Oversight

The inspectors through interviews with upper-level plant management, interviews with mid-level and first line supervisors and review of detailed plant staff organization charts, determined that the plant organization as related to spent fuel integrity is adequate. The inspectors determined that both the Radiation Protection Manager and the Manager of Oversight (Quality Assurance) have a direct reporting link to the Director of Site Operations, which assures independence from plant operations.

The inspectors reviewed the numbers of plant staff and contractor personnel and the adequacy of management support to this staff. The inspectors conclude that staff size and management support is adequate.

CY management has instituted a "Work Observation Program" which is designed to provide self assessment of the recent changes effected by the CY management. Supervisory and management personnel have been trained in this program and CY plans to bring in outside expertise to participate in the program.

(2) Quality Assurance

The quality assurance function at CY has been renamed Oversight. The inspectors reviewed many audits of the former Quality Assurance organization dated from to July 1996 through 1997 and interviewed quality assurance personnel including the department manager. Based on the audit reviews and the personnel interviews, the inspectors find the new Oversight organization to be adequate.

(3) Foreign Material Exclusion (FME)

The inspectors interviewed a member of the plant staff responsible for this program and also reviewed two of the program documents, Foreign Material Control and Spent Fuel Pool Housekeeping. In addition, the inspectors conducted a walkdown of the fuel pool. Licensee self-assessments identified areas for improvement in FME controls (ACR 97-497). Based on these considerations the inspectors conclude that CY has an adequate FME program in place.

(4) Fire Protection

The inspectors verified that the licensee has a fire protection program and that it was applied to the structures and systems related to spent fuel storage. The inspector reviewed the Fire Hazards Analysis description for SPENT FUEL AREAS (Fire Area F-

1, Zones A, B, C, D) and confirmed that hazards in the zone were as analyzed, and that the credited fire detection (ionization/smoke) and suppression equipment were provided as described in the FHA. The inspector toured the spent fuel areas to verify that plant conditions for transient combustibles matched those analyzed in the FHA.

Resident inspections of routine activities during testing and inspections have found the staff performed well to assure the TRM requirements have been met, such as during the times to troubleshoot the diesel fire pump, or to conduct required surveillances which require entry into the TRM action statements. The inspector verified that fire brigade was being maintained per the requirements of TRM II.1.a for staffing, shift coverage, qualifications. The inspector reviewed records for the period of April 27 to July 19, 1997 and verified the licensee met the requirements to maintain a five man fire brigade (FB). This review identified that two crews (D & E) were light on qualified FB members, which has resulted in significant administrative effort and NSO rotations to keep the brigade staffed. The licensee had actions in progress to train and qualify the recently hired contractors in operations to augment the qualified FB staff.

Based on the above, the inspector concluded that the licensee had adequately applied the fire protection program to the spent fuel area. The control of SFB fire hazards and fire protection program controls was good.

(5) Maintenance of Fuel Pool and Associated Equipment

NRC Regulation 10 CFR 50.65(a)(1) requires the licensee of a permanently shut down plant to maintain the spent fuel in a safe condition and outlines the scope of an acceptable maintenance program for such a plant. The inspectors, as noted in Section (7) below, reviewed Procedure PMP 9.9-146, related to freeze protection, interviewed the Maintenance Manager and conducted a walkdown of the Fuel Storage Building and its systems. This limited inspection did not show any inadequacies in the maintenance program.

(6) Fuel Pool Water Chemistry

The licensee maintained a well defined chemistry program with PORC approved procedures in effect (CHM 7.4-1 and SUR 5.4-4). The procedures were technically acceptable and implemented the requirements of TS 3/4.9.1 and 3/4.9.13. The program established limits for contaminants that will assure clarity and purity of pool water. The limits were based on original Westinghouse specifications. The inspector reviewed data for samples collected to date in 1997. Analyses were made of the parameters listed in Section 6.4/Attachment A, and at the frequency required by the procedure.

Licensee radioisotopic analyses results showed there were no indications of fuel leaks in pool or clad defects. Chemistry parameters/impurities were maintained within the established limits, and deviations were highlighted for supervisory review and trending. One exception was for silicates (SiO2), which has consistently exceeded

the limit of 1.0 ppm (in the range of 1.02 to 1.41 in 1997). The licensee had a justifiable basis for accepting this condition, and demonstrated there was no corrosive action on the fuel. The licensee planned to re-evaluate the 1.0 limit and intends to process a procedure change as part of the transition to the nuclear island (ACR 97-467 and QA Surveillance CY-P-97-063).

As noted above, deviations in chemistry parameters were generally highlighted for supervisory review and trending. One exception to good performance was that the out of specification SiO2 parameter had not been highlighted or trended. This matter was discussed with the Chemistry Manager during the briefing on July 25, 1997, who stated the matter would be addressed.

The SFP makeup water is nuclear grade primary water, with no relaxation in standards planned. The boron-10 concentration was maintained per license requirements, to assure the K-effective limits were satisfied. The SFP skimmer and purification systems were normally in service to maintain pool clarity. Licensee data showed consistently good decontamination factors across the SFP ion exchangers. Pool cleanliness conditions were very good, with good clarity and no large debris visible by observations from the deck. One minor exception was that the skimmer was not fully effective in removing debris (bugs) on NW corner of pool. The licensee subsequently addressed this condition. While no debris on top of the fuel was visible form the deck, fuel debris in past had impacted the ability to complete the audit of special nuclear material per the procedure requirements. This area was also the subject of recent licensee findings (ACR 97-655). Licensee engineering staff was reviewing the industry operating experience regarding debris in the SFP for lessons learned and applicability to Haddam Neck.

In summary, the oversight and control of SFP chemistry and water purity was very good.

(7) Leakage, Siphon and Freeze Concerns

The licensee has conducted a study of those piping systems that communicate with the SFP and could possibly produce a siphoning event. The inspectors reviewed the study, interviewed cognizant licensee personnel involved in the study, reviewed system drawings, and conducted an independent walkdown of the SFP and its systems to determine if any pipe or hose lines, not shown in the drawings or study, might provide a potential siphon path. This walkdown confirmed that there does not appear to be any such undocumented siphon paths.

Siphoning or pool drainage could also be related to a freezing event. Such an event could only occur in pipe lines or components that communicated with the SFP and had an outdoor component in the system. The only such system is the Spent Fuel Pool Purification Loop. This is a pipe line that is insulated and electrically heat traced in the outdoors portion of the system. The heat trace circuit contains an ammeter which is monitored every 8-hours and would indicate a loss of electrical heat. There is a level monitor in the SFP that alarms in the Control Room and would immediately

indicate a pipe break due to any cause. The licensee plans to take this loop out of service after the winter of 1997/98 and replace it with a totally indoor loop, thus eliminating the freeze hazard. If failure of the current freeze protection is postulated, it would take more than the 8-hour interval of operator rounds to cause the warm flowing water in the pipe to freeze, expand and burst the pipe. The licensee has an established preventive maintenance program for the heat trace circuit that is contained in procedure, PMP 9.9-146, Freeze Protection Equipment Preventive Maintenance. This procedure was reviewed by the inspectors and found adequate.

The licensee has noted ambiguous indications of minor leakage from the pool liner. Small amounts of water are collected periodically from a standpipe at the southeast corner of the SFP. The water has shown boron and radioisotopes, but not at concentrations that match those in the spent fuel pool. This matter has been the subject of past NRC review (reference Inspection Item 94-09-02), as well as recent focus by the licensee to improve the leakage monitoring program and further investigate the liner status (ACRs 97-608, 658). Licensee actions to investigate SFP liner leakage will be followed on a subsequent inspection.

Based on the above considerations, the inspectors conclude that leakage monitoring, siphoning and freeze protection at the Haddam Neck Station as related to spent fuel integrity meets the intent of TI Sections 03.05 Siphon Concerns and 03.06 Freeze Concerns.

(8) Training

Connecticut Yankee has in place, a detailed training program for both new and experienced employees at the Haddam Neck Plant. The inspectors reviewed only those programs related to the maintenance of spent fuel integrity under normal and exigent conditions. The inspection was conducted through interviews with Training Department personnel, review of Training Department Manuals, review of training aids, review of course content and other details of training related to spent fuel integrity. These programs covered both requalification training for licensed operators and non-licensed operator continuing training. The Senior Resident Inspector attended a CY training session. NRC currently has under review the Certified Fuel Handler Training Manual. Certified fuel handlers will replace licensed operators only after the NRC issues a license amendment to that effect.

Based on the above considerations, the inspectors conclude that the training programs at the Haddam Neck Station as related to spent fuel integrity meet the intent of TI Section 03.11 Training.

c. Conclusions

The licensee was working to implement Bulletin 94-01 and should complete this work by the end of 1997. For the portions of the Bulletin areas that were inspected at this time, the inspectors found all of the programs reviewed in Sections (1) through (8), above, to be adequate. This area will remain open until after the NRC reviews the

licensee's response to the bulletin, and pending further NRC review of the results of the liner leakage monitoring program (**IFI 97-05-04**).

E8 Miscellaneous Engineering Issues

E8.1 Review of LERs and Telephonic Notifications (URI 97-05-05)

a. Inspection Scope (92700, 90712)

The purpose of this inspection was to review prompt reports and licensee event reports (LERs) to verify the requirements of 10 CFR 50.72 and 50.73 were met.

b. Observations and Findings

The following event reports were found to be acceptable. The references in parentheses refer to the sections of this report that describe further NRC review of the event. The LERs listed below are considered closed.

- LER 97-11, SFP Cooling System Outside the Design Basis*
- LER 97-12, Excessive Check Valve Seat Leakage (Section M1.1)
- LER 97-13, Inadvertent Halon System Discharge (Section O1.5)
- LER 97-14, Containment Isolation Actuation (Section O4.1)
- LER 97-15, RMS Test Not per Technical Specifications (Section R2.1)

* This event was reviewed in Inspection 97-03, Section E2.3

The inspector reviewed licensee actions to make prompt notifications to the NRC per 10 CFR 50.72, including those made on: July 29 for Event 32693 (SW check valve leakage), August 4 for Event 32719 (SFP Cooling Flow Test), August 7 for Event 32736 (Halon Event), August 9 for Event 32745 (Containment Isolation), and October 10 for Event 33027 (Offsite Contamination). Notifications on August 25 (Event 32812) and October 3 (Event 33026) concerning the spent fuel building ventilation system were still under NRC review at the conclusion of this inspection, and will be reported in a subsequent NRC inspection. Except as noted below, the inspector had no further comments in this area.

On July 24, 1997, the licensee completed a test of a check valve in the service water (SW) supply to the SFP heat exchangers, SW-CV-963. The valve failed the acceptance criteria by allowing greater that 2 gpm backflow. The excessive back leakage rendered the valve incapable of performing its design functions to mitigate a water hammer during loss of normal power events. The check was declared inoperable, and ACR 97-484 was written to initiate corrective actions and a reportability evaluation.

ACR 97-484 was reviewed by the Management Review Team (MRT) on July 25, and was assigned to system engineering to complete a reportability evaluation within 5 days. The engineering review on July 29 determined that the failure to meet the test acceptance criteria placed the spent fuel pool cooling system in a condition outside its design basis (see LER 97-12) and was reportable per 10 CFR 50.72(b)(1)(ii)(B). The telephone notification was made to the NRC duty Officer at 10:19 a.m. on July

29. However, the inspector reviewed the above sequence of events, and questioned why the report had not been made on July 24 when the valves was declared inoperable. The inspector's concerns were discussed with the Unit Director on July 29. The licensee's review of the reportability sequence was provided in memorandum REB 97-800 dated August 1, 1997, which concluded that the 50.72 notification was not timely and should have been made at the time the check valve was declared inoperable on July 24. The licensee initiated ACR 97-530 in response to this concern.

As recently as March 1997, the licensee had completed a reportability evaluation which concluded that a water hammer event in the service water system could render the SFP cooling system inoperable, and that SW-CV-963 was necessary to eliminate the potential for this event. Potential contributing factors for the untimely 50.72 report included: whether the Shift Managers had been provided adequate information regarding the March 1997 evaluations; whether the individuals involved in the reportability reviews on July 24 had sufficient information to recognize the significance of the failed check valve test; the licensee test procedures (SUR 5.7-217) did not provide clear guidance on the significance of the failure to meet the test acceptance criteria; and, the MRT reviews on July 25 were not sufficient to recognize the significance of the degraded valve conditions. The licensee's evaluation of the event identified similar findings.

The inspector reviewed the licensee's performance history to complete timely reports per 50.72. Although reporting practices generally meet the requirements, past NRC findings regarding adequate reporting were described in Inspection Item 96-11-08. The inspector determined that the licensee action to address the violation described in Item 96-11-08 might have prevented the untimely reporting of the July 24 event; however, problems were noted in completing commitments, as described in section E1.3 above.

Licensee actions to address the inadequacy identified in ACR 97-530 and to assure the timely reporting of conditions will be reviewed on a subsequent inspection. The adequacy of licensee actions to assure events are reported per 50.72 is unresolved (**URI 97-05-05**).

c. Conclusions

Mixed performance was noted to make timely reports per 10 CFR 50.72, and to complete corrective actions to improve the reportability process.

IV. Plant Support

R1 Radiological Protection and Chemistry (RP&C) Controls

R1.1 Offsite Contamination and Radiation Surveys

a. Inspection Scope (83729)

The purpose of this inspection was to review the licensee activities to monitor preliminary scoping onsite surveys for site characterization, and to conduct reviews of offsite properties for potential contamination from licensed material.

b. Observations and Findings

Inspection 97-08 reported the NRC review of licensee efforts to complete onsite scoping surveys for site characterization, and to identify the extent and nature of licensed materials that became uncontrolled and released from the plant site. Licensed material was identified in a landfill located outside the protected area but on the owner controlled area (ACR 97-450). Inspection 97-08 addressed that matter. Inspection 97-07 described past NRC reviews and licensee surveys of private property offsite that received fill material from Haddam Neck. During this inspection period, the NRC reviews of licensee efforts to conduct contamination surveys both onsite and offsite continued.

The NRC worked with the licensee and the Connecticut Department of Environmental Protection (DEP) to conduct radiation surveys offsite, and in public accessible areas onsite. The offsite radiation surveys included gamma scans, fixed point surveys, in-situ gamma spectroscopy and environmental samples that were split three ways for independent analyses. The inspector reviewed the conduct of the licensee surveys by independently monitoring radiation instrumentation readouts as surveys were taken, and by assuring instrumentation was properly calibrated. NRC split samples were analyzed by the Region I laboratory in King of Prussia, Pennsylvania.

The survey of offsite areas was still in progress at the end of this inspection. A summary of the NRC's analyses and findings will be provided in a subsequent inspection when all surveys are completed. For all offsite areas surveyed as of October 6, 1997, no plant related activity was identified except in one, that designated as Survey Location 9608.

Survey 9608

During interviews with licensee personnel on October 1, the inspector identified that the licensee analysis of a soil sample from Location 9608 was potentially positive for cobalt 60 (Co-60). The preliminary licensee finding was identified on September 29, but no action was taken to confirm or communicate the results. The licensee suspected that the sample may have been contaminated by handling within the onsite laboratory located inside the radiation controlled area. Actions were in progress in

October 1 to ship the licensee samples to the environmental laboratory in Massachusetts.

The inspector immediately informed NRC management and the Connecticut DEP of the potential positive results so that NRC and DEP samples could receive expedited processing and analysis. The licensee was requested to count its samples a second time onsite, which was analyzed as negative for Co-60 after wiping the external surface of the sample container. The samples were sent on an expedited basis to the environmental laboratory. By October 2, both licensee and DEP analyses were reported positive for CO-60. The NRC results were also positive, as listed below:

Sample	Co-60 Result (picoCi/gm)
9608CS001	0.076 +\ - 0.004
9608CS002	0.075 +\ - 0.004
9608CS003	0.076 +\ - 0.004
9608CS004	0.025 +\ - 0.004

NRC, licensee and DEP results were in general agreement. The property owner was notified of the results. The licensee issued a press release summarizing the sample results, and provided an assessment of contamination level, and the associated exposure dose rates. The NRC's independent assessment indicated that the trace levels of Co-60 produced no measureable dose rate of above background using micro-R meters. Further, NRC analyses of the potential dose resulting from the trace contaminates, indicated that the annual dose received would be significantly less than that received from natural background (i.e., approximately less than 1% of that received for natural background.) Licensee, NRC and DEP actions were in progress at the conclusion of the inspection to fully assess the causes, extent and required corrective actions for the contaminated soils at Location 9608.

On October 2, 1997, a telephone conference was conducted between NRC Management and the Haddam Neck Director of Site Operations and Decommissioning to review the performance weaknesses relative to the initial onsite handling of the 9608 samples and the communication of preliminary results. Protocols and expectations for the communication of samples results were established. The licensee abandoned the practice of bringing the soil samples into the RCA for a preliminary analysis prior to processing at the environmental laboratory.

Requests from Concerned Citizens

The inspector also responded to requests from citizens during the period, who had not received fill from the site but were concerned regarding the potential for radioactivity on their property. The inspector responded to residences at Maple Avenue in East Haddam on October 4, and at Rock Landing Road in East Hampton on October 21. The inspector conducted radiation measurements using a calibrated Eberline E600 survey instrument with an HP 300 geiger-mueller probe. The detector was sensitive to radiation at environmental levels. The inspector performed exposure

rate measurements at both locations in areas of interest to the property owners. No readings above those typical of natural background radiation were identified.

c. Conclusions

NRC reviews of licensee offsite contamination surveys continued at the end of the inspection, along with an assessment of the licensee past practices for handling potentially contaminated materials and fill from the site. Licensee practices to process environmental samples in the onsite counting laboratory were poor, as was the preliminary handling of sample 9608 and the communication of preliminary results.

R1.2 Review of Radiological Controls and Radiation Surveys

a. Inspection Scope (83729)

The purpose of this inspection was to review the licensee activities to provide radiological control of plant activities.

b. Observations and Findings

During inspection tours, the inspector toured the radiological controls area and reviewed radiological controls and contamination controls. Access to various radiologically controlled areas and the use of personnel monitors and frisking methods upon exit from those areas was also observed. Posting and control of radiation areas, contaminated areas and hot spots, and labeling and control of containers holding radioactive materials were verified to be in accordance with licensee procedures.

The inspector reviewed the licensee follow-up to the discovery of a hot particle on the spent fuel bridge on August 15, 1997, which was discovered during surveys in support of inspections to document the fuel inventory in the pool. The particle read 50 mRem/hr with an RO-2 closed window reading, and 150 mRem/hr in the open window reading.

Work was stopped and the bridge was evacuated. Personnel were checked for contamination by frisking and the PCM-1. No personnel contamination was found. The particle was removed for further analysis and large area swipes were completed to locate any other particles. None were found. The licensee believes the particle came from the spent fuel pool as tools were removed during the inventory work. The event was documented in ACR 97-624).

c. Conclusions

The radiological controls for routine work was acceptable. No inadequacies were identified in the licensee follow-up of the discovery of a hot particle.

R2 Status of RP&C Facilities and Equipment

R2.1 Effluent/Process Radiation Monitoring Systems (RMS) Calibration

a. Inspection Scope (92904)

During the previous inspection of the radioactive liquid and gaseous effluent control programs conducted on February 3-7 and February 24-26, 1997, an apparent violation (EEI 50-213/97-02-01) and an unresolved item (URI 50-213/97-02-02) were identified relative to the RMS calibration methodology (See Inspection Report No. 50-213/97-02 for detail). The licensee submitted to the NRC the "Revised Commitments and Corrective Actions" for the apparent violation on August 7, 1997. During these inspections (August 12-13 and October 6-9, 1997), the inspector reviewed the licensee's corrective actions to determine their effectiveness.

b. Observations and Findings

b.1 Adequacy of Revised RMS Calibration Procedures and Techniques

The inspector reviewed the following revised calibration procedures and calibration results of effluent/process RMS to determine the adequacy of the corrective actions:

- Main Stack Noble Gas Radiation Monitor (R-14A);
- Main Stack Wide Range Noble Gas Radiation Monitor (R-14B);
- Radioactive Liquid Effluent Radiation Monitor (R-18);
- Spent Fuel Pool Radiation Monitor (R-19); and
- Test Tank Effluent Radiation Monitor (R-22).

Revised electronic and radiological calibration procedures associated with the above RMS were well developed and incorporated applicable industry specifications and guidance (e.g. Regulatory Guide, ANSI, and EPRI). Calibration results were within the licensee's acceptance criteria, including linearity tests and conversion factor determination. The inspector noted that the licensee's data reduction techniques were sufficient to demonstrate the validity of the calibration results. The inspector noted that the licensee purchased new calibration sources and used correct geometry for the liquid RMS calibration. The inspector also noted that the above RMS were operable during this inspection.

The licensee stated that the electronic and radiological calibration procedures will be combined as one procedure in the near future to avoid multiple work orders. The inspector stated that one procedure for the electronic and radiological calibration was a common practice and was acceptable to the NRC. The licensee's decision to delete the steam generator blowdown radiation monitors (R-16 A&B) from the TS/ODCM requirements was acceptable since this monitor is no longer used, since cessation of plant operations.

b.2 Flowmeters, Isokinetic Nozzle, and ScanRad Computer System

The licensee ordered identical flowmeters for R-18 and R-14A. These flowmeters were scheduled to be installed and calibrated for use by September 30, 1997. The inspector reviewed calibration results and the results were acceptable.

The licensee identified that the sampling station for the main stack noble gas radiation monitor (R-14A) was not provided with the isokinetic nozzle, however, the main stack wide range noble gas radiation monitor (R-14B) was connected to an isokinetic sampling device. A redundant sampling pathway was installed, using the R14B isokinetic nozzle, to permit isokinetic sampling with the R-14A monitor. The inspector verified that the corrective action for this issue was complete and acceptably performed.

The licensee used the ScanRad computer system for RMS data acquisition, however, the system had malfunctioned about one month after installation. Subsequently, a new ScanRad computer system was installed with upgraded software. The inspector confirmed that the system has operated reliably since June 20, 1997.

b.3 UFSAR and Technical Specification (TS) Adequacy

The licensee reviewed the UFSAR and TS requirements for the effluent/process RMS as part of the review of unresolved item, URI 50-213/97-02-02.

On August 13, 1997, during review of the UFSAR/TS requirements, the licensee identified a discrepancy involving the channel functional test relative to the table notation [Tables 4.3-7, Radioactive Liquid Effluent RMS; and 4.3-8, Radioactive Gaseous Effluent RMS] of the TS and the TS definition. Tables 4.3-7 and 4.3-8 of the TS requires the performance of a quarterly channel functional test for the subject effluent RMS channels. This quarterly requirement refers to the channel functional test as an Analog Channel Operational Test (ACOT) in the Table Notations. The notation described that the ACOT shall demonstrate that control room alarm annunciation occurs if any of the following conditions exist:

1. Instrument indicates measured level above the alarm/trip setpoint;
2. Instrument indicates a downscale failure or circuit failure; and
3. Instrument controls not set in operate mode.

However, Section 1.2 of the TS defines that "An ACOT shall be the injection of a simulated signal into the channel as close to the sensor as practicable to verify OPERABILITY of alarm, interlock and/or trip functions. The ACOT shall include adjustments, as necessary, of the alarm, interlock and/or Trip Setpoints such that the Setpoints are within the required range and accuracy." The quarterly test method in SUR 5.1-11 did not use a simulated signal to perform the ACOT as described in Section 1.2 of the TS. The setpoints were lowered to the point below the current detected levels to actuate the subject alarms and verify operability, but the installed detectors were utilized in lieu of a simulated signal.

The licensee initiated an Adverse Condition Report 97-612 to establish corrective actions, to evaluate the issue for reportability and operability, and to track deposition of the item. The RMS were considered operable since action had been completed in July 1997 to re-calibrate the RMS using new procedures that met the TS definition for ACOT. The licensee planned to use the new calibration procedures to check the RMS channels as the next quarterly test came due, pending the development of new procedures that incorporated the TS requirements. The licensee developed and issued procedures SUR 5.2-134 (RM 14A), 5.2-135 (RM 18) and 5.2-136 (RM 22) on October 10, 1997. The new procedures incorporated a test method that injected a test signal as close to the detector as practicable. The licensee reported this event to the NRC per 10 CFR 50.73(a)(2)(1)(B) as licensee event report LER 97-15.

The inspector was informed that the review of the UFSAR/TS was ongoing. As a result of this review, the licensee committed to update the UFSAR/TS as appropriate. Accordingly, the licensee submitted the "Defueling TS" change to NRR. The inspector reviewed the Defueling TS with respect to the RMS. The final updated UFSAR, with associated documentation, was reviewed during the inspection conducted on October 6-9, 1997. The inspector did not identify any discrepancies with the Defueling TS or UFSAR.

The licensee was requested by the NRC to evaluate the impact of any potential inaccuracy on past operation by comparing past surveillance results with the results obtained using new calibration sources and improved procedures. An independent historical operability assessment was performed by a contractor. The contractor identified several weaknesses which resulted in reduced sensitivities and increased the uncertainties for effluent RMS over the years. Although these weaknesses existed, the calibration data suggested that all effluent monitors reviewed were adequate to monitor and detect increases in normally expected effluent releases with the exception of R-22, the waste test tank monitor. This monitor had several significant weaknesses which affected the operability and accuracy of the monitor for many years. Notwithstanding, the inspector noted that the final discharge water was monitored by the radioactive liquid effluent radiation monitor (R-18), downstream of R-22.

b.4 Root Cause Evaluation

The licensee submitted the root cause evaluation results of the previously identified RMS deficiencies to the NRC (Revised Commitments and Corrective Actions dated August 7, 1997). The inspector reviewed the root cause evaluation results. The licensee identified that the RMS inaccuracies were introduced during a major revision to calibration procedures which inadvertently changed the calibration methodology and the responsibility (from the Chemistry Group to the I&C Group). The following causes were identified by the licensee:

- inadequate management oversight of the work transition process;
- weak engineering input during procedure revisions;

- lack of followup on previously identified problems with the ScanRad computer; and
- inadequate Plant Operations Review Committee (PORC) review of the procedure revisions.

The licensee evaluated the effectiveness of the PORC review process and made improvements through: (1) changes in membership; (2) process changes in the administrative controls; (3) clarification of expectations; and (4) training PORC members in the associated responsibilities and performance expectations.

The Oversight Department participated in several elements of the RMS improvements including: (1) review of calibration procedures; (2) review of documentation for calibration source traceability; (3) observation of the work activity; (4) review of system modification documentation and implementation; (5) program enhancements; and (6) oversight of engineering input during procedure revisions.

The licensee's corrective actions pertaining to the ScanRad Computer were described in Section b.2 of this inspection report.

c. Conclusions

The licensee's corrective actions described in the "Revised Commitments and Corrective Actions" were considered to be well conceived and executed. The inspectors made the following conclusions based on the above reviews and findings:

- Revised calibration procedures contained necessary steps, as recommended by Regulatory Guides, ANSI, and EPRI guidance to perform meaningful calibration of the effluent/process RMS;

- Calibration results were within the licensee's acceptance criteria and were well defined in the revised calibration procedures;

- Calibration data reduction technique was sufficient to demonstrate the validity and reliability of the RMS;

- Subject effluent/process RMS were operable at the time of this inspection;

- The licensee commitments for installation of flowmeters and the isokinetic nozzle described in Section b.2 were complete;

- The review process for the UFSAR/TS adequacy was appropriate and effective;

- The evaluation of the historical calibration results (evaluation for the impact of any potential inaccuracy on past operation by comparing past surveillance results with the results obtained using new calibration sources and improved

procedures) suggested that all effluent monitors (except R-22) were adequate to monitor and detect normally expected increases in effluent releases.

- The licensee performed good root cause evaluations, including improvement of the PORC review process; and

- Functions and responsibilities of the Oversight Department appeared appropriate to detect an early sign of the program breakdown or safety focus neglect.

R8 Miscellaneous RP&C Issues (92904)

R8.1 (Open) Apparent Violation, EEI 50-213/97-02-01: Effluent/process radiation monitoring systems (RMS) had been improperly calibrated because procedural guidance was inadequate: (1) no documentation or poor documentation of the electronic calibration data; (2) no performance of in-situ primary calibration; (3) no plateau curve to determine optimum operating high voltage; (4) incorrect performance of the secondary calibration; and (5) no determinations of conversion factors and linearity for the intended monitoring ranges. This area remains open pending NRC staff review of safety significance and final enforcement action.

R8.2 (Closed) URI 50-213/97-02-02): The 10 CFR 50.59 implications regarding RMS calibration discrepancies. The licensee's actions were acceptable, as described in Section R2 of this inspection report.

S1 Conduct of Security and Safeguards Activities

S1.1 Containment Air Quality

a. Inspection Scope (83729)

The purpose of this inspection was to review the security activities at the site, and the licensee response to an industrial safety issue.

b. Observations and Findings

The implementation of the physical security program was reviewed during inspection tours of the plant. The security controls for the access to the protected and vital areas were maintained.

On September 13, 1997, the licensee notified the inspector that a security guard had been relieved of duty early on the mid shift due to nausea caused by an odor that emanated from the containment. The relocated the guards to an area away from the affected area, and to prohibit unrestricted entry into the containment until the cause for the odor could be investigated and analyzed. The source of the odor was not known, but it occurred in conjunction with the start of the containment air recirculation (CAR) fans on September 11 following an extended period in shutdown.

An Industrial Hygienist was consulted to assist in the investigation and to obtain samples necessary to evaluate containment air quality. The odor abated considerably by September 15. After taking the samples on September 16, the containment purge was reestablished on September 18. An analysis of the containment air samples showed trace quantities of 8 chemicals: toluene, benzene, ethyl benzene, perchloroethylene, xylene, butyl acetate, trichloroethane, and hexane, with the most prevalent being hexane and benzene. None of the chemicals were known to be used at the site. The trace amounts measured based on the concentrations present on September 16 were below toxic levels for the chemicals.

At the conclusion of the inspection, licensee actions were still in progress to investigate the cause of the event and identify the source of the chemicals, and to evaluate the quality of conditions inside the containment. A representative of the Occupational Safety and Health Administration was involved with a review of the event and the licensee's response.

c. Conclusions

NRC review noted that security requirements were satisfied. Routine NRC reviews of site activities will follow the licensee resolution of this industrial safety issue.

V. Management Meetings

X1 Exit Meeting Summary

The inspector presented the inspection results regarding the radiation monitoring system to the licensee on August 13, and October 9, 1997. The licensee acknowledged the findings.

The inspector presented a summary of inspection results to the Unit Director at the conclusion of the inspection on October 17, 1997. The licensee acknowledged the findings presented.

PARTIAL LIST OF PERSONS CONTACTED

Licensee

+ * G. Bouchard, Unit Director
+ J. Bourassa, QA Supervisor
* S. Carnesi, System Engineer
J. DeLawrence, Supervisor, Engineering Programs
J. Dawson, Operator Training Specialist
N. Fetherston, Decommissioning Project Manager
+ J. Haseltine, Engineering Director
D. Heffernan, Maintenance Manager
+ * S. Herd, Chemistry Manager
+ * R. Mellor, Director, Site Operations and Decommissioning
J. Pandolfo, Security Manager
J. Pointkowski, Shift Manager
R. Sexton, Radiation Protection Manager
+ J. Tarzia, HP/Chemistry Technical Support
+ B. van Nieuwenhuise, Chemistry Supervisor
+ G. van Noordennen, Licensing Manager
G. Waig, Operations Manager
J. Warnock, Quality Assurance Manager
A. Nerriccio, Public Information

NRC

+ * W. Raymond, Sr. Resident Inspector
* M. Fairtile, Project Manager, NRR
R. Nimitz, Senior Health Physicist

* Denotes those present at the exit meeting on August 13, 1997.
+ Denotes those present at the exit meeting on October 13, 1997.

The inspectors also interviewed other licensee personnel.

DEP, State of Connecticut

Michael Firsick, Radiation Control Physicist
Kevin McCarthy, Director, Radiation Control Division

INSPECTION PROCEDURES USED

IP 40500:	Effectiveness of Licensee Controls in Identifying, Resolving, and Preventing Problems
IP 62707:	Maintenance Observation
IP 61726:	Surveillance Observation
IP 64704:	Fire Protection Program
IP 71707:	Plant Operations
IP 83729:	Occupational Exposure During Extended Outages
IP 92700:	Follow-up of Written Reports of Nonroutine Events at Power Reactors
IP 92902:	Follow-up - Engineering
IP 92903:	Follow-up - Maintenance
IP 93702:	Prompt Onsite Response to Events at Operating Power Reactors

ITEMS OPEN, CLOSED, AND DISCUSSED

Open

97-05-01	IFI	Corrective Actions for Halon Actuation
97-05-02	URI	Procedures for Decommissioning Operations
97-05-03	URI	Actions to Address SF Building Ventilation
97-05-04	IFI	Actions to Address Bulletin 94-01 Issues
97-05-05	URI	Adequacy of Reports per 50.72

Closed

97-02-02	URI	The 10 CFR 50.59 implications regarding RMS calibration discrepancies.
97-11-00	LER	SFP Cooling System Outside the Design Basis
97-12-00	LER	Excessive Check Valve Seat Leakage
97-13-00	LER	Inadvertent Halon System Discharge
97-14-00	LER	Containment Isolation Actuation
97-15-00	LER	RMS Test Not per Technical Specifications

Discussed

97-01-01	URI	Status of Defueled Systems
97-11-08	VIO	Reporting Degraded Equipment Conditions
97-02-01	EEI	Effluent/process radiation monitoring systems (RMS) had been improperly calibrated because procedural guidance was inadequate

LIST OF ACRONYMS USED

ACP	Administrative Control Procedure
ACR	Adverse Condition Report
AEOD	Office for Analysis and Evaluation of Operational Data
ALARA	As Low As Is Reasonably Achievable
ANN	Annunciator Response Procedure
AOP	Abnormal Operating Procedure
CAR	Containment Air Recirculation
CFR	Code of Federal Regulations
CYAPCo	Connecticut Yankee Atomic Power Company
DEP	Department of Environmental Protection
EA	Escalated Action
EDG	Emergency Diesel Generator
ENG	Engineering Procedure
EOP	Emergency Operating Procedure
EPIP	Emergency Plan Implementing Procedure
ESF	Engineered Safety Feature
F	Fahrenheit
gpm	gallons per minute
IR	Inspection Report
LDB	Licensing and Design Basis
LER	Licensee Event Report
NOP	Normal Operating Procedure
NCV	Non-Cited Violation
NRC	Nuclear Regulatory Commission
NRR	Nuclear Reactor Regulation
NSO	Nuclear Side Operator
NUSCO	Northeast Utilities Service Company
ODCM	Offsite Dose Calculation Manual
PDR	Public Document Room
PORC	Plant Operations Review Committee
PSDAR	Post Shutdown Decommissioning Activities Report
QA	Quality Assurance
QC	Quality Control
RFO	Refueling Outage
RMS	Radiation Monitoring System
RPM	Radiation Protection Manager
RWPs	Radiation Work Permits
RWST	Refueling Water Storage Tank
UR	Surveillance Procedure
SW	Service Water
TRM	Technical Requirement Manual
TS	Technical Specification
UFSAR	Updated Final Safety Analysis Report
WCM	Work Control Manual

ATTACHMENT I
AUGUST 7, 1997 HALON ACTUATION
SEQUENCE OF EVENTS

0944	Picture Taken of the Halon Control Panel - Internal Alarm
0946	Second Picture Flash - Halon Discharge Occurred
0947	Evacuation of Control Room
0953	Evacuation of central alarm system (CAS)
1008	CR Fire Detection System Defeated - alarm silenced; entered TRM
1009	CR Ventilation System Placed in Smoke Evacuation Mode
1009	Central Alarm Station/SSS entered with SCBA
1020	Air sample CAS - normal
1033	CAS Resumed Normal Manning
1034	Air Sample in Control Room - normal
1034	Control Room Resumed Normal Manning
1045	Declared Unusual Event
1116	Control Board Walkdown Completed - No abnormal conditions noted
1149	Primary Side Operator Completed Second Set of Rounds
1235	Secured from Unusual Event